Space Weather Technical Forecast

Issued on Thursday 24 October 2024 at 01:12 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C7.8 at 23/1212UTC from AR3863 near the south-centre disc. This is a relatively simple bipolar group, showing sign of decay, with its trailer fading. There are nine regions currently on the visible disc, however two are soon moving over the western solar horizon, AR3859 and AR3860. Otherwise the main activity is with a collection potentially complex sunspot regions moving onto the southeast limb. While currently difficult to assess, these continue to be followed by complex looping evident on SDO aia-imagery, and remain bright on SDO aia-94.

A number of weak CMEs were observed leaving the Sun, however these have all been assessed as missing Earth. The C7.8 flare appears to not have produced a CME, however a significant euv-dimming was observed at the same time across the north disc. This CME has been assessed as passing north of Earth.

Solar Wind / Geomagnetic Activity: Solar winds showed a weak enhancement, attributed the belated onset of the fast wind from CH82/-. Solar wind speed, observed by ACE at L1, rose from background to be slightly elevated, from 320km/s to peak 440 km/s at around 23/1800 UTC. Density was initially above average but eased to be below average by 23/1200 UTC. The Interplanetary Magnetic Field (IMF) remained mostly weak, with brief Moderate spells, varying between 4-11nT. The north-south component was also variable between -9nT and +7nT. Phi angle persisted positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels. High energy electron flux (greater than 2MeV) observed by GOES16 remained at background, with the associated 24-hour fluence well below the Active threshold. The 24/0000UTC observation was 1.13e6 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate is expected, with a chance of isolated M-class flares and a slight chance of X-class flares. This is mainly due to the regions rotating onto the southeast disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Ongoing fast winds from CH82/+ are expected to ease day 1 (24 Oct), with background winds by day 2 (25 Oct). The next enhancement from the fast winds of CH84/- is expected day 3 and easing day 4 (26-27 Oct), with

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further slight elevated to elevated winds likely. Geomagnetic activity is forecast to be Quiet to Unsettled with a chance of Active intervals at first. This easing to many Quiet day 2 (25 Oct). Any further CH84 sourced enhancement will bring a spell of Unsettled to Active, with a slight chance of G1 Minor Storms day 3-4 (26-27 Oct).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background. High energy electron flux at GOES16 is forecast to remain to persist at mainly background, with the associated 24 hour fluence remaining well below Active.

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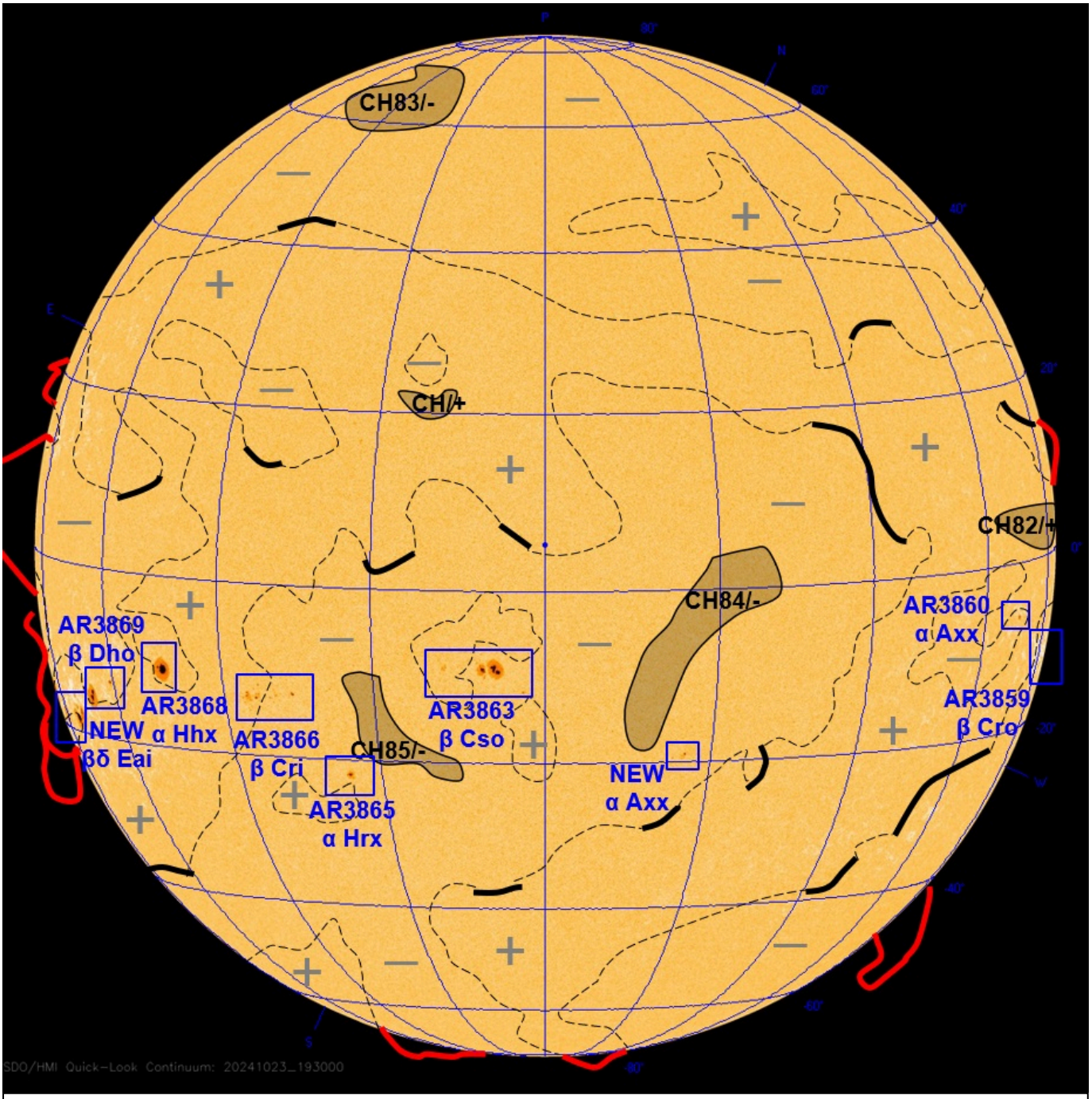
Figure 1: Solar Synoptic Map 23/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

The are no Earth-directed CMEs.

Currently slightly elevated winds are due to the belated connection to the weaker than anticipated CH82/+ fast winds. These are expected to ease day 1 (24 Oct), with background slow winds likely returning. The next enhancement is then likely to be from CH84/-. Based on the currently location of the feature, onset is considered most likely to occur day 3 (26 Oct), with any fast wind easing on day 4 (27 Oct), perhaps peaking at elevated speeds but most likely slightly elevated (450-500km/s), however this is of a less favoured polarity for a strong geomagnetic connection at this of year. Confidence is low, however, as MOSWOC Enlil, currently has two enhancements indicated, on 24 Oct (day 1) and 27 Oct (day 4). The first of these is currently considered too soon, while any onset on day 4 (27 Oct), would suggest only a very weak connection.

Quiet to Unsettled with a chance of Active intervals at first. This easing to many Quiet day 2 (25 Oct), before onset of any enhancement from CH84/-. This is most likely day 3, or early day 4 (26-27 Oct), bringing a spell of Unsettled to Active geomagnetic activity, with a slight chance of G1 Minor Storms.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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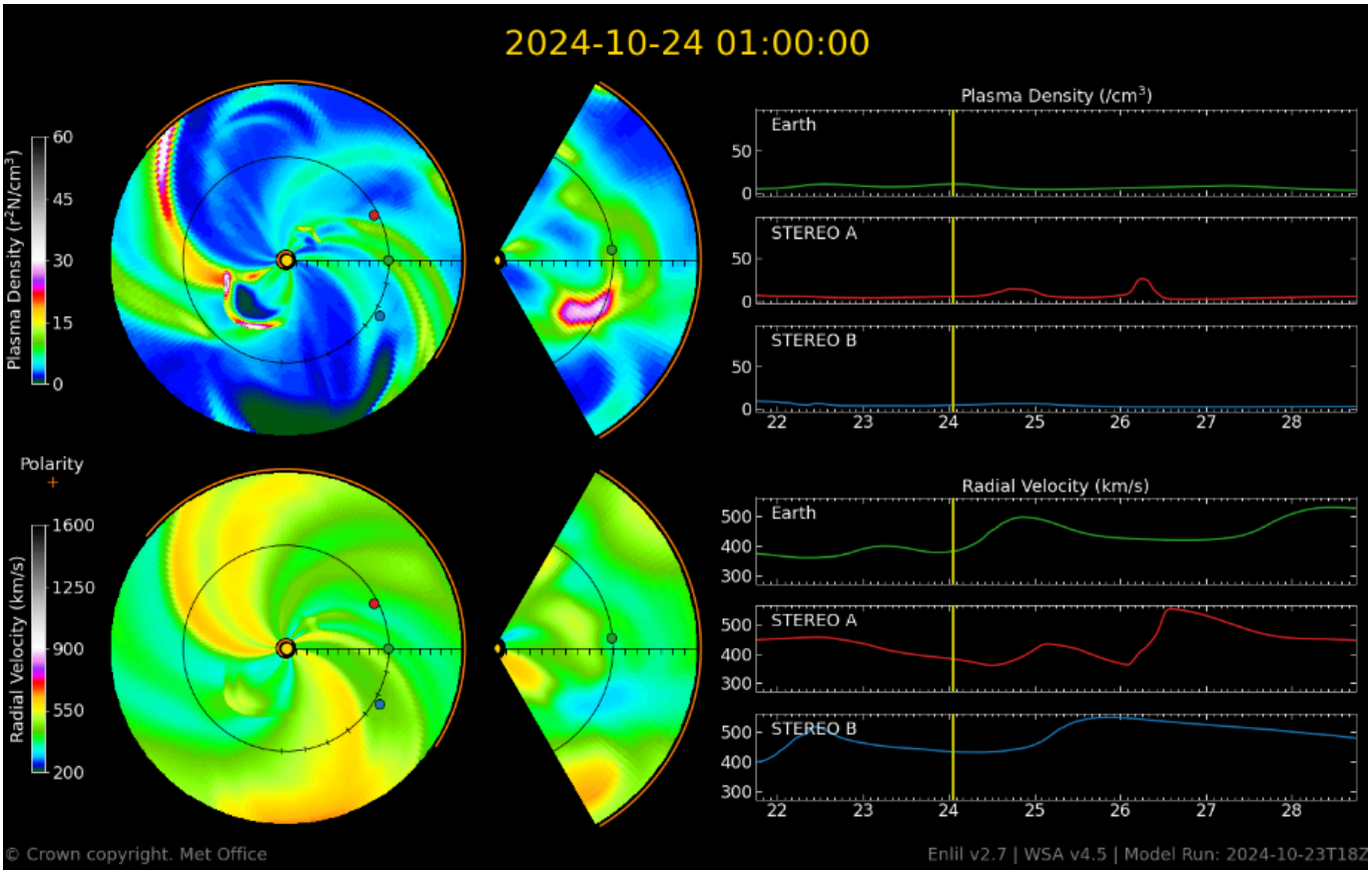
Figure 2: MOSWOC Enlil. Enhancements indicated on 27 Oct likely to occur earlier than indicated, with enhancement on 24 Oct considered anomalous.



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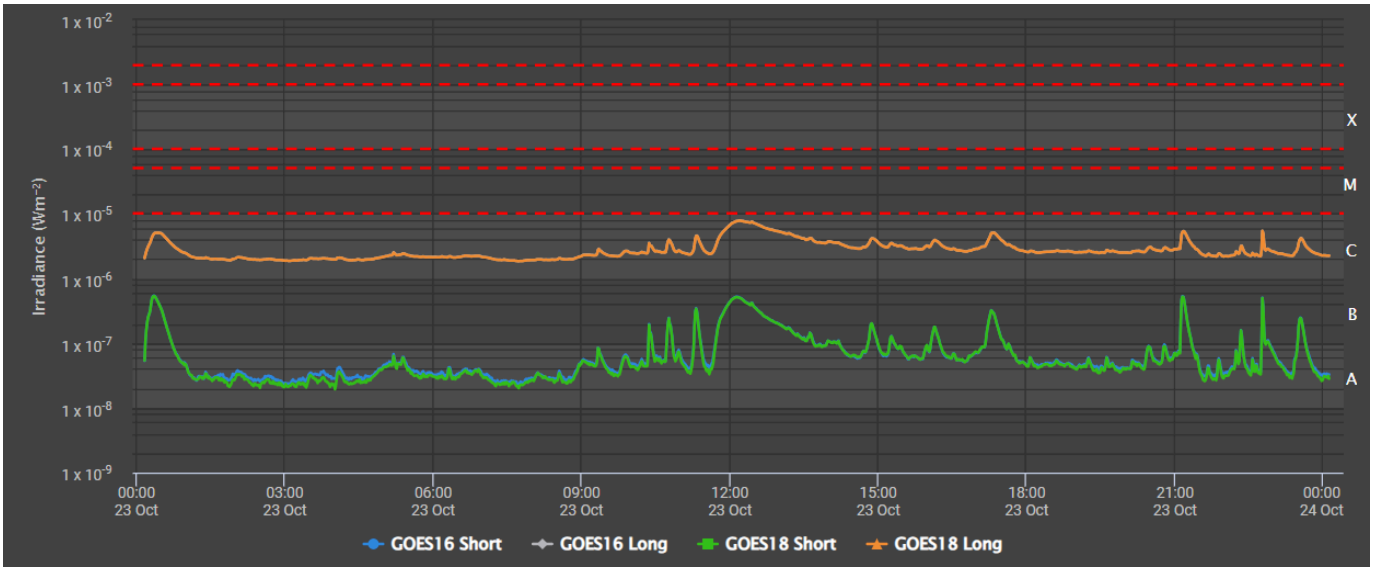
Radio Blackouts - X-Ray Flares

Low to Moderate activity is expected, with isolated M-class flares likely and a slight chance of X-class flares.

There are now nine sunspot containing active regions on the disc. The majority of these are small and simple, with AR3859 and AR3860 both becoming hard to see as they approach the west disc. The main focus of activity is the southeast disc with a number of relatively small but potentially complex regions rotating onto the disc. This includes AR3869, which is currently assessed as a simple bipolar spot, however foreshortening of its main trailer spot, is leading to low confidence in this assessment. The new region closest to the the southeast limb is perhaps the most complex of these with some suggestion of a compound mixed polarity leader spot, leading to a delta configuration, however this is also low confidence. There are also signs of a further spot rotating onto the disc, as indicated in far-sided seismographic images, however this is yet to rotate into a visible position. SDO imagery, e.g. aia-94 also remains very bright on this limb, supporting the likelihood of further sunspots and potential complexity to move onto the disc. Despite the recent low activity, these oncoming regions result in the increased potential for M or X-flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	60	60	60	60
Very Active	R3-R5 (X Class)	No	10	10	10	10

Figure 3: GOES 16-18 X-ray Irradiance



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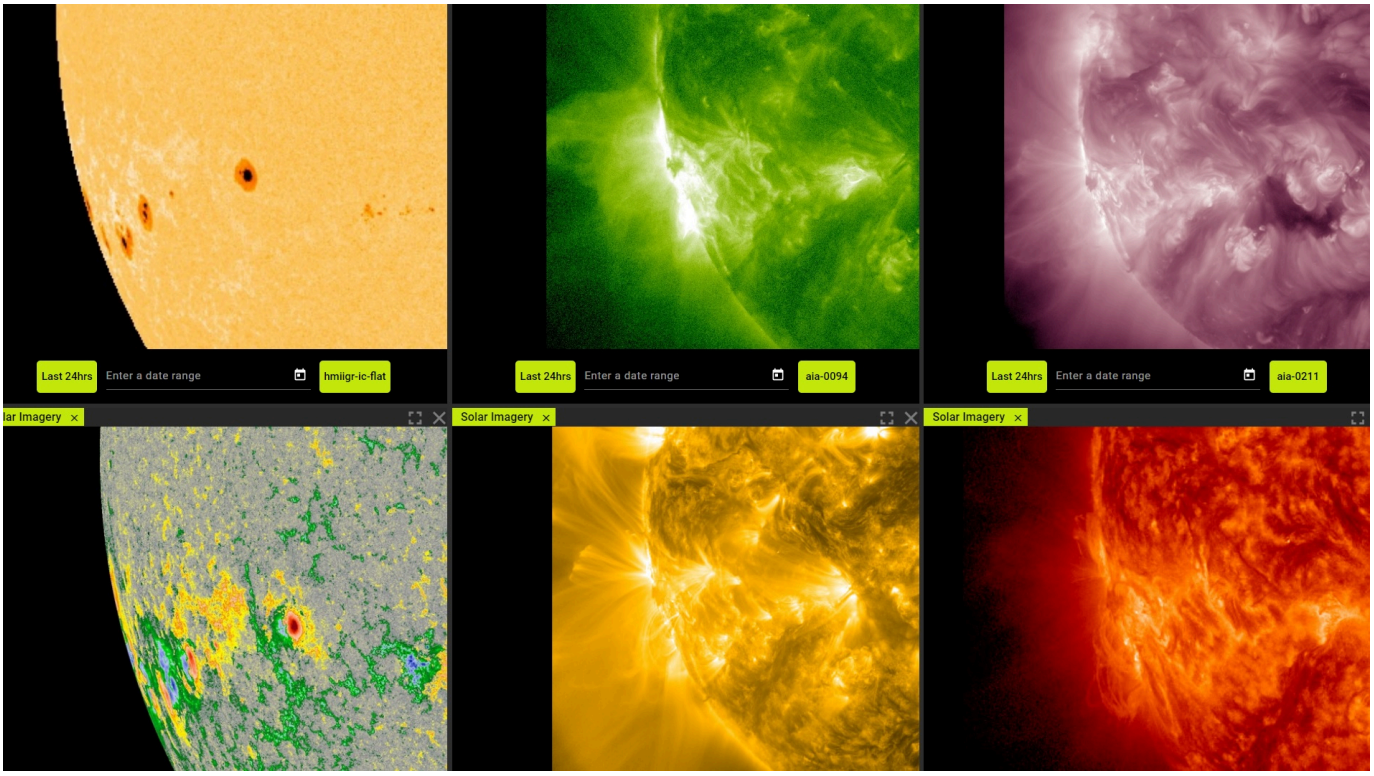
Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is forecast to remain at background, with the current most active regions located near the east limb, and no notable regions currently on the west disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	2	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: SDO Imagery showing potential complexity on southeast limb.



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High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is currently at background, and are expected to persist mainly at this level with no significant enhancements expected.

The associated 24-hour fluence is currently expected to remain well below Active throughout the period, with MOSWOC REFM providing good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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